Long-Term Response Decision Support Tool for Debris-Flow Mitigation

Step 1: Calculate Debris Volume

Compile input values:

+ Area of slopes > 30% (17˚) = _____ km^2
+ Area of moderately and severely burned slopes = _____ km^2
+ Design Storm Total = _____ mm

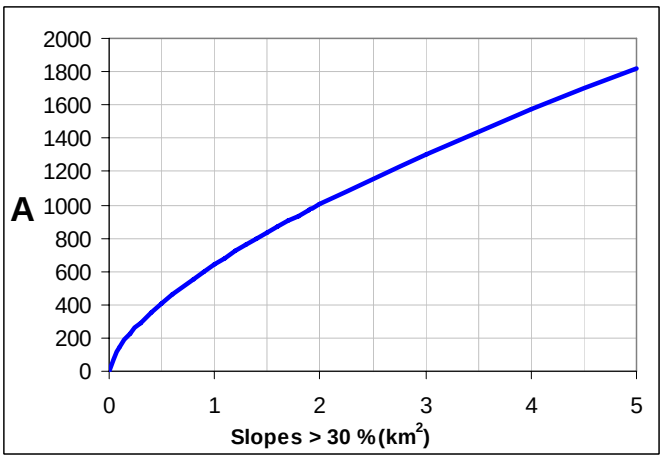
+ Based on the values above determine the value for A, B, and C from the graphs.

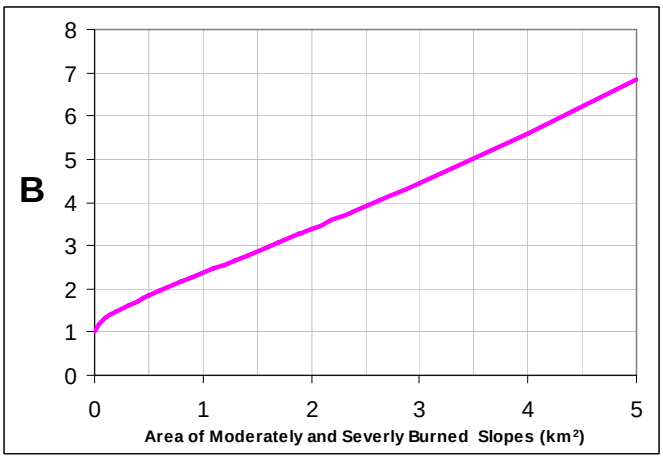
A = _____
B = _____
C = _____

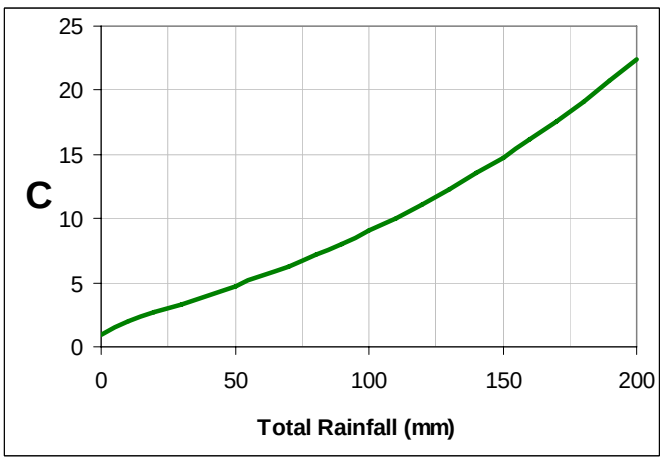
Volume (m^3) = A x B x C

Note: Debris flow volumes determined by the Western U.S. Model (Gartner, 2005) with 68% confidence limits. Equation provided below.

$V=EXP(0.65(\ln S)+0.86(B^{1/2})+0.22(R^{1/2})+6.46)$







Step 2: Identify Risk

Basin Risk Level

Critical: Potential to impact vital infrastructure, human life, or create large environmental problems.

Moderate: Significant Impact to secondary roads and structures, low risk of loss of life, and minor environmental problems.

Low: Little or no potential to impact life, secondary structures, or environment.

Negligible: Not a consideration.

Step 3: Select Treatment Based on Risk and Cost

Treatment Recommendations Based on Assessed Risk

Critical: Relocation, debris basin, debris rack, or deflection berm,

Moderate: Relocation, debris basin, debris rack, or deflection berm.

Low: None.

Negligible: None.

Relative Cost (2005) per ???
< $400
$400 to $800
> $800

Note: Costs are cumulative, and may vary based on site constraints.

Engineering Considerations:

- Debris-flow volume
- Frequency of occurrence
- Maximum discharge and flow depth
- Potential impact forces
- Potential runout distance
- Potential runup and superelevation
- Probable storage angle
- Flow magnitude
- Gradation of coarse degree

Other Considerations:

- Available space
- Location of other structures
- Channel gradient
- Channel geometry

Treatment Options[1]

Relocate	Pros	• Remove risk
	Cons	• High cost • Public relations
Debris Basin	Pros	• Very effective at preventing debris-flow damage downstream • Effective for a large debris-flow volume
	Cons	• Large area necessary at mouth of channel • Topography may make debris basin unfeasible • Very expensive
Debris Rack	Pros	• Very effective at preventing debris-flow damage downstream • Effective for a moderate volume
	Cons	• Runout zone is necessary • Specialized materials and equipment necessary • Risk of failure due to poor design/construction • Very expensive
Deflection Berm	Pros	• Relatively easy to construct • Minimum amount of equipment needed on site • Relative low cost for construction
	Cons	• Need alternate runout zone • May need to import rip rap if none available on site • Risk of failure due to poor design/construction

Footnotes:

[1] Further information on long-term alternatives is discussed briefly in the supplemental report where additional references are provided.